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A new subspecies of *Morpho telemachus* (Linnaeus, 1758) from northeastern Brazil (Lepidoptera: Nymphalidae)

L. A. R. Leite, E. Carneiro, O. H. H. Mielke & M. M. Casagrande

Abstract

The description of a new subspecies, *Morpho telemachus miersi* Leite, Carneiro, Mielke & Casagrande, ssp. n., based on morphological and natural history data of adults and immatures from a forest fragment in savanna of northeast Brazil is presented. Illustrations, photographs and scanning electron microscopy images are also included.
KEY WORDS: Lepidoptera, Nymphalidae, life cycle, Menispermaceae, *Morpho telemachus miersi*, taxonomy, Brazil.

**Una nueva subespecie de *Morpho telemachus* (Linnaeus, 1758) en el noreste de Brasil
(Lepidoptera: Nymphalidae)**

Resumen

Se presenta la descripción de una nueva subespecie, *Morpho telemachus miersi* Leite, Carneiro, Mielke & Casagrande, ssp. n., basado en características morfológicas y la historia natural de adultos e inmaduros en un fragmento de bosque en la región de la sabana del noreste de Brasil. También se incluyen ilustraciones, fotografías e imágenes de microscopía electrónica.

PALABRAS CLAVE: Lepidoptera, Nymphalidae, ciclo de vida, Menispermaceae, *Morpho telemachus miersi*, taxonomía, Brasil.

**Uma nova subespécie de *Morpho telemachus* (Linnaeus, 1758) do nordeste do Brasil
(Lepidoptera: Nymphalidae)**

Resumo

A descrição de uma nova subespécie, *Morpho telemachus miersi* Leite, Carneiro, Mielke & Casagrande, ssp. n., com base nos caracteres morfológicos e de história natural de adultos e imaturos em um fragmento florestal na região de cerrado do nordeste do Brasil é apresentada. Ilustrações, fotografias e imagens de microscopia eletrônica de varredura estão também incluídas.

PALAVRAS CHAVE: Lepidoptera, Nymphalidae, ciclo de vida, Menispermaceae, *Morpho telemachus miersi*, taxonomia, Brasil.

Introduction

Morpho Fabricius, 1807 is among the most peculiar genera of butterflies, widely recognized by the distinct bluish wing patterns and large size, being one of the groups most targeted by amateur collectors (PENZ & DEVRIES, 2002; GUERRA-SERRUDO & LEDEZMA-ARIAS, 2008). Therefore,

its taxonomy, phylogenetic history and evolution have been extensively explored in the literature (PENZ & DEVRIES, 2002; BLANDIN, 2007; CASSILDÉ *et al.*, 2010; DEVRIES *et al.*, 2010; CASSILDÉ *et al.*, 2012). Biological aspects concerning the immature stages are known for some species (CONSTANTINO, 1997; CONSTANTINO & CORREDOR, 2004; HEREDIA & ÁLVAREZ-LÓPEZ, 2007; GUERRA-SERRUDO & LEDEZMA-ARIAS, 2008; MONTERO-ABRIL & ORTIZ-PÉREZ, 2010), and hostplant associations (BECCALONI *et al.*, 2008; ROBINSON *et al.*, 2011). Morphology of immature stages has been studied (BORQUIN, 1948; YOUNG, 1972; YOUNG & MUYSHONDT, 1973; FURTADO, 2000; CONSTANTINO & CORREDOR, 2004; GALLUSSER *et al.*, 2010), but detailed data on the external morphology, e.g. chaetotaxy or scanning electron microscopy, remain largely unavailable, despite the usefulness of these techniques for systematics (TRAUTWEIN *et al.*, 2012).

Morpho telemachus (Linnaeus, 1758), together with five other species, comprise the subgenus *Iphimedea* Fruhstorfer, 1912 (BLANDIN, 2007). While some of the species are localized, *Morpho telemachus* was already recorded throughout the Amazon basin, extending west to the low Andean slopes, from Bolivia to Colombia, and east to the coastal Atlantic Forest in northeast Brazil (BLANDIN, 2007). Variation in wing coloring pattern is observed in populations from different parts of its distribution, which contributed to a proliferation of subspecific names (BLANDIN, 2007; SCHÄFFLER & FRANKENBACH, 2008, 2009), sometimes without observing other aspects besides wing coloration. Both the immature stages and the biological aspects of *Morpho telemachus* have been addressed previously (BRÉVIGNON, 2003; GALLUSSER *et al.*, 2010), resulting in the recognition of two different subspecies. Here we describe a previously unknown third subspecies of *Morpho telemachus* from central northeast Brazil, based on morphological characters of the adult and immature stages.

Material and Methods

Descriptions of the adults are based on the terminology of BLANDIN (2007), while STEHR (1987) and DIAS (2006) were used for the external morphology of the larva and pupa respectively. Additionally, terminology adaptations based on other morphological studies of immature Lepidoptera were also used (MOSHER, 1916; PETERSON, 1962; CASAGRANDE, 1979; SCOBLE, 1992; DUARTE *et al.*, 2005; SPECHT & PALUCH, 2009).

Adults and two independent egg batches were collected in Poço Azul ($7^{\circ} 13' S$, $46^{\circ} 27' W$, 390 m), Riachão, Maranhão, Brazil. The eggs were brought to the southern region where they were kept until they developed into adults. After hatching, the larvae were kept with the plant *Abuta selloana* (Benth.) Eichler (Menispermaceae) throughout the life cycle, due to the absence of the original host plant (fig. 33) in the region, which is possibly a species belonging to the same genus, but has not been identified up to date. The development took place under natural temperature conditions, part at the Laboratório de Estudos de Lepidoptera Neotropical, Centro de Ciências Biológicas, Universidade Federal do Paraná, Curitiba, Paraná, part in Rio Natal, São Bento do Sul, Santa Catarina, with the primary purpose of maintenance of the larvae. Some of the specimens were kept for behavioral and morphological studies in plastic cages along with the branches of the host plant, the cages being frequently observed and cleaned daily, while the plants were changed periodically.

At each new stage, a minimum of three individuals was preserved for measurements and morphological studies. Larvae were initially sacrificed in boiling water and then fixed in 10% Kahle-Dietrich solution. Head capsules and pupal exuviae were kept dry in plastic containers. Drawings and measurements were made using a stereoscopic microscope with camera lucida and micrometer lens attached. Optical microscope was used for the studies of chaetotaxy in the first larval instar. Photographs in scanning electron microscopy were performed using the equipment Jeol® model JSM - 6360LV at the Centro de Microscopia Eletrônica of the Universidade Federal do Paraná (CEM - UFPR).

Preserved immatures and adults are deposited in the Coleção Entomológica Pe. Jesus Santiago

Moure - Lepidoptera (DZUP; DZUPIL) of the Universidade Federal do Paraná, Curitiba, Paraná, Brazil.

Acronyms follow below with their curators between parentheses:

BMNH: The Natural History Museum, London, England (MSc. Blanca Huertas, MSc. Geoff Martin, Dr. David Lees).

CGCM: Coleção Carlos Guilherme Costa Mielke, Curitiba, Paraná, Brazil.

CZMA: Coleção Zoológica do Maranhão, Laboratório de Estudos dos Invertebrados, Centro de Estudos Superiores de Caxias, Universidade Estadual do Maranhão, Caxias, Maranhão, Brazil (Dr. Francisco Limeira-de-Oliveira).

DZUP: Coleção Pe. Jesus Santiago Moura, Departamento de Zoologia, Universidade Federal do Paraná, Curitiba, Paraná, Brazil (Dr. Olaf H. H. Mielke, Dr. Mirna M. Casagrande).

MNHN: Muséum National d'Histoire Naturelle, Paris, França (Dr. Jacques Pierre).

Results

Morpho telemachus miersi Leite, Carneiro, Mielke & Casagrande, ssp. n.

Material Studied (Figs. 1-5, 10-13): Holotype ♂ with the following labels: /HOLOTYPE/ Brasil, Maranhão, Riachão, Poço Azul, 12-IV-2011, [O.] Mielke & Casagrande leg./ o abdome, embora colado, pertence ao exemplar / *Morpho telemachus miersi* Leite, Carneiro, Mielke & Casagrande det. 2012/ DZ 25.406/. DZUP. Allotype female with the following labels: /ALLOTYPUS/ Brasil, Maranhão, Riachão, Poço Azul, 5-XII-2010, O. - C. Mielke & Carneiro leg. / *Morpho telemachus miersi* Leite, Carneiro, Mielke & Casagrande det. 2012/ DZ 25.407/. DZUP.

Paratypes: same locality of the holotype. 11 ♂♂, 5-XII-2010 (DZ 25.408 to DZ 25.418); 19 ♂♂, 12-IV-2011 (DZ 25.045, DZ 25.419 to DZ 25.438), DZUP. 1 ♂, 12-IV-2011 and 1 ♀, 26-XII-2011 donated to the BMNH; 1 ♂, 5-XII-2010 and 1 ♀, 27-XII-2011 donated to the MNHN (Dr. Patrick Blandin); 3 ♂♂ and 1 ♀, 5-XII-2010 in the collection CGCM. From larvae collected in the field and fed with leaves of *Abuta selloana* in São Bento do Sul, Santa Catarina, Brazil, 34 individuals were generated (13 ♂♂ and 21 ♀♀), all of them paratype specimens of reduced size (♂♂ with 57-66mm and ♀♀ with 51-61mm on the length of the forewing), probably due to incorrect change of host plant, they are as follows: same locality of the holotype, 2 ♂♂, 28-X-2011; 2 ♂♂, 29-X-2011; 1 ♂, 4-XI-2011; 1 ♂ and 1 ♀, 19-XI-2011; 1 ♀, 6-XII-2011; 1 ♂, 7-XII-2011; 1 ♂, 12-XII-2011; 1 ♂, 13-XII-2011; 1 ♂, 14-XII-2011; 2 ♂♂, 21-XII-2011; 2 ♀♀, 22-XII-2011; 1 ♀, 23-XII-2011; 4 ♀♀, 26-XII-2011; 1 ♂ and 1 ♀, 27-XII-2011; 1 ♀, 31-XII-2011; 1 ♀, 1-I-2012; 2 ♀♀, 2-I-2012; 4 ♀♀, 3-I-2012; 1 ♂, 7-I-2012 (DZ 25.374 to DZ 25.405). Brasil, Maranhão, Carolina, Povoado Campo Grande, Balneário Urupuxete, 23-27-II-2009, F. Limeira-de-Oliveira, A. L. Costa & M. M. Abreu leg. 3 ♂♂ and 2 ♀♀, CZMA.

Diagnosis: Males with 65-79 mm and females with 75mm wing span. Male wings with light bluish green color pattern in the basal area, slightly shiny, especially on the hindwing, extending posteriorly to the anal region of the same wings and giving space to increasingly more olivaceous and opaque tones towards the discal area of both wings. All variations of *M. telemachus telemachus* and *M. telemachus foucheri* differ from this pattern, presenting different mixtures of blue-purple color with orange (figs. 7, 8). *M. telemachus jorgei* has yellowish brown tones in the median area rather than olivaceous and its forewing submarginal spots are reduced and triangular shaped instead of rounded and developed as in the new subspecies. *M. telemachus persephone* (fig. 6) has mostly dark coloration on the forewing, with reduced blue-green color on the basal region and it also does not feature developed submarginal spots. Pupillary stains are usually more developed in the new subspecies than in *M. telemachus jorgei* and *M. telemachus persephone*. As illustrated in other subspecies (SCHÄFFLER & FRANKENBACH, 2010), the presence and development of the anterior ocellar spots on the ventral forewing is variable. Female similar to male, but with more developed yellow tones. Ventral coloration quite varied, from reddish brown to grayish brown. Morphological patterns of the male genitalia (figs.

10-13) similar to *Morpho telemachus telemachus*, as illustrated by LE MOULT & RÉAL (1962) and personally observed, except for a more pointed valvae. *Morpho ricardus* also have pointed valvae, but the gnathos is flat instead of spoon-shaped. Membranous part of the valvae varies between individuals.

Type Locality: -7.2225, -46.4533. A resort frequented by tourists, about 26 km from the city of Riachão, characterized by a great depression with predominance of dense forest vegetation, isolated by areas of Cerrado.

Geographic Distribution: BRAZIL - Maranhão: Carolina, Balsas (Fazenda Nova Holanda, specimens observed), Riachão. The adults were seen flying over the gallery forest, rarely dispersing over the Cerrado vegetation. In the region, the gallery forests are isolated from the major forest formations on the west (Amazon rainforest) and east (Atlantic Forest), serving as a natural mechanism of isolation of species populations in dry regions such as the Cerrado.

Host Plant: Original host plant unknown (fig. 33), probably a Menispermaceae, egg batches and larvae were found on a bush (fig. 34). Throughout the rest of the life cycle in the South, the larvae were fed on *Abuta selloana* (Benth.) Eichler (Menispermaceae).

Phenology: Adults observed in two periods, early April and December.

Etymology: The name of the subspecies pays tribute to Herbert W. Miers, collector of butterflies and collaborator of researchers in Brazil and abroad.

Immature Stages (Figs. 14-32, 35-38, 40-68)

Egg (Figs. 14-16, 45-47).

Semi-gregarious egg batches, the eggs remain together, but separated by some irregular distance between them. Initially the egg is a cream color, with the micropilar region dark brown on the upper pole. The egg becomes nearly hyaline close to hatching time, revealing the larva inside, which makes it apparently orange-brown on the upper pole due to the head capsule. Spherical, unornamented with the lower pole flattened in contact with the substrate. Measurements: 2.0 mm diameter; 1.5 mm height. Duration of the stage: 6-10 days. (n = 150 egg batch 1; n = 170 egg batch 2).

1ST INSTAR LARVA (Figs. 17-22, 40, 41, 48-58).

Subtriangular head, orange-brown with numerous setae distributed all over the epicranium, short setae on the frontal and stemmata regions with the same color of the head capsule, other setae reddish-brown, long and distally branched, distributed in the lateral and dorsal regions of the epicranium. Dorsoposterior projection of the epicranium with bifid aspect. Triangular frons, located in the inferior half of the head, delimited by the epicranial suture laterally and inferiorly by the clypeus, this one as a narrow rectangular sclerotized band, ventrally limited by the membranous anteclypeus. Bilobed labrum with serrated lateral edge, six pairs of setae present, M1 antero-ventral to M2, closest to the longitudinal midline of the head; M3 ventral to M2 on the distal margin of the labrum, three lateral setae (L), L1 being the most basal on the edge, L2 median and L3 distal and close to M3 (fig. 51). Mandibles strongly sclerotized with smooth and dark brown distal edge, presenting two conspicuous setae close to the basal region (fig. 52). Six stemmata located on the latero-inferior region of the epicranium with an "S" shape, all of them of similar size, stemmata 1, 2, 3, 4 arranged in a semicircle, stemma 5 posteroventrally to the others and near the base of the antenna, stemma 6 dorsolateral to stemma 5 and closest to it in relation to the other stemmata (fig. 49).

Tegument of the thorax purple or slightly brownish depending on light incidence. Prothoracic shield with the same coloration as the remaining prothorax. Jugular gland medio-ventrally located and close to the region where the head merges with the prothorax. Rest of the body with mixed coloration, cream from the dorsal region to the height of the subventral setae group (SV); with purple spots distributed as follows: dorso-medially and rounded shape in A1, dorsally as two arc-shaped bilateral bands in A2, in A3 as a transverse band with globular shape on the lateral edges, on the posterior third of A4 and anterior of A5, on A7 similar to A3 and purple from the posterior third of A7 to the anterior margin of the anal shield. Setae distributed throughout the body with pale yellow coloration. Pale yellow anal shield. Second larval instar similar to the first in color and shape.

Pale yellow thoracic and abdominal legs. Abdominal legs of A3-A6 and A10 with crochets arranged in uniordinal mesopenellipse.

Measurements: Head capsule: 1.3 mm wide at the level of the stemmata region, 1.55 mm height. Average length of the larva: 6.6 mm. Duration of the stage: 20 days (n = 100).

CHAETOTAXY

Thorax (Fig. 41). Prothorax: Eleven pairs of primary setae distributed among other smaller bristles. Dorsal setae (D) on the dorsoposterior half of the prothoracic shield, D1 anterior to D2. Subdorsal group (SD) posteroventral to the dorsal group, SD1 anterodorsal to SD2. Rounded spiracle, the largest among the other spiracles of the body. Lateral setae (L) anteroventral to the first spiracle, L1 anterodorsal to L2. Subventral group (SV) and microventral (MV) close to each other and located below the median-longitudinal line, SV1 and SV2 dorsal to the others, the first being anterior to the second. Three microventral setae: MV1 anterior to the others, MV2 posteroventral to SV2 and MV3 anteroventral to MV2. Eso and Metathorax: Eleven pairs of setae. D1 anteroventral to D2, both on the dorsoposterior half of the segment. SD1 ventral to D1; SD2 anteroventral to SD1. Three lateral setae: L1 posterodorsal to the others; L2 anterodorsal to L3. SV1 anteroventral to the lateral setae. Microventral setae close to the base of the coxa: MV1 posterodorsal to the others; MV2 anteroventral to MV1 and MV3 ventral to MV2.

Abdomen (Fig. 41). A1 - A2: Ten pairs of setae. D1 close to the anterior margin of the segment and anterior to D2, this one close to the posterior margin. SD1 ventral to the dorsal setae on the median line between these. Three conspicuous setae of the lateral group along with another ones of reduced size: L1 posterodorsal to L2, the latter posteroventral to the spiracle and closest to this one in relation to the other lateral setae; L3 posteroventral to L1 and L2. Subventral setae (SV) posteroventral to the lateral group and below the median-longitudinal line, SV1 anterodorsal to SV2. MV1 anteroventral to the subventral setae on the median-transversal line. V1 reduced and ventral to MV1.

A3 - A6: Distribution of setae similar to the previous segment, except for the absence of SV2, MV1 and V1.

A7: Distribution of setae as in A1 and A2, however SV2 bigger and anteroventral to SD1; MV1 absent.

A8: Distribution of setae similar to the previous segment, except for the absence of the subventral group (SV).

A9: Six pairs of setae. D1, D2 and SD1 in similar disposition to the other abdominal segments. Two lateral setae anteroventral to SD1, L1 posterodorsal to L2. V1 reduced on the posteroventral margin of A9.

A10: Six pairs of conspicuous setae among numerous bristles of reduced size on the segment. D1 close to the dorsoanterior margin of the anal shield; D2 posterior to D1; SD1 ventral to the dorsal setae on the median line; SD2 posteroventral to SD1 on the posterior region of the shield. PP at the paraproctum, posteroventral to the anal shield. V1 close to the anteroventral margin of the segment.

5TH INSTAR LARVA (Figs. 28-32, 59-68).

Red head with numerous setae of the same color that cover the entire surface of the epicranium. Epicranial suture evidenced by a light-pink band from the dorsal region to the ventral end of adfrons. Two light-pink bilateral wavy bands from the dorsal region to the stemmata region at the height of the lateral setae. Narrow light-pink band above the frons at the region where the epicranial suture is divided. This character is absent in the 4th instar, which is similar to the fifth instar in color and shape (Figs. 23-27), as well as in the third instar.

Rest of the body mixed in color, predominantly red, though with white regions with small irregular black spots distributed from T2 to A8 from the dorsal region to the lateral side at the height of the median-longitudinal line. Abdominal legs and anal shield with light-pink coloration. Dorsal setae

arranged in clumps of light-pink color and subdorsal region with yellowish-brown setae in clumps, the other setae on the body with yellowish-brown coloration.

Abdominal legs from A3 to A6 with crochets arranged in triordinal mesoseries and triordinal mesopenellipse on the crochets of A10.

Measurements: Head capsule: 0.6 cm wide at the level of the stemmata region, 0.8 cm height. Average length of the larva: 4.4 cm. Duration of the stage: 25-30 days (n = 20).

Prepupa (fig. 32). Slightly dorsoventrally curved, head keeping the conformation of the 5th instar, body coloration yellowish-green with yellowish spots around the abdominal spiracles and on the intersegmental regions from A5 to A8. Dorsal and subdorsal setae arranged in "clumps" with the same color of the 5th instar larva; the other setae orange and located below the median-longitudinal line. Duration: 2-3 days.

PUPA (Figs. 35-38, 42-44).

Adecticous obtect; fusiform, with large diameter at the regions of A3 and A4. Attached to the substrate by the cremaster acceded to the silk usually made on the stemmata of the host plant. Integument thin, smooth and without ornamentation, initially pale light-green and uniform, passing smoothly to a darker coloration when closer to the adult emergence. Distal extremity of the dorsal head projection slightly purple. Rounded protuberance with cream color next to the forewing on the intersegmental region between A3 and A4. A10 region olive-green with ochre color laterally, hooks of the cremaster with dark brown coloration.

Vertex on a dorsal concavity of the head, between two dorsal "horn-shaped" expansions of similar length to the width of the eye. Subquadangular smooth frons. Pentagonal-shaped labrum, small and limited superiorly by the clypeus, bilaterally by the mandibular region and inferiorly by the base of the galea. Oval-shaped eye, bordered by basal third of the antenna, this one with striated aspect with the base located on the dorsoposterior region of the head close to the anterior margin of T1 and ending at the posterior third of the forewing not reaching the margin of this. Prothoracic leg initiated on the lateroventral margin of the eye and ending at the half length of the galea; mesothoracic leg wider than the prothoracic and ending with the galea on the distal third of the antenna. T1 subrectangular, the smaller among the thoracic segments; T2 the biggest, with the forewings occupying its largest surface; T3 dorsolaterally extended to the half of A4 and following the margin of the wing. Thoracic spiracle elliptical, located on the lateral-inferior margin of T1 and lateral to the antenna. Abdomen with 10 segments, wider in A3 and A4 and decreasing toward the cremaster. Spiracles elliptical, being bigger in A3 and A4, A8 spiracle the smallest and the others of similar size.

Length of pupa: 2.62 cm. Duration of the stage: 10-20 days. (n = 15).

Behavioural Data

Females seek the host plant after fertilization, egg batches can be laid on the adaxial or abaxial side of the leaf. After hatching the larvae feed on the corium and stay together in a circular arrangement at the opposite side of the egg batch. The first feeding of plant tissue only occurs 24 hours after hatching. When assembled, after hatching, the larvae form some kind of circular aggregation (fig. 19) with the heads pointing outwards. The formation of this aggregation is made by backward movements, where larvae are positioned side by side only moving backwards on the space between the others. The feeding during the first larval instar usually occurs in the morning and evening, however, not all feed simultaneously, but in small groups of about ten larvae, while the others stay in the circle.

During the fourth instar, the larvae often, when at rest, form groups in the shape of "clusters/bunch" that occupy the leaf from the base of the petiole to the middle portion of the blade (figs. 26-27). The larvae spin a large amount of silk on the base of the petiole between this and the stems of the host plant. They feed in small groups that remain side by side in parallel (fig. 24).

preferably at night. During the day the larvae remain in aggregations, eliminating large quantities of feces.

In the last instar, the larval aggregation occurs only on the leaves, where they remain in groups side by side (fig. 31). Large amounts of silk are woven by the larvae on the leaf margins, keeping them together (fig. 30). Near the pupal stage, the larvae seek an appropriate place and form the prepupa (fig. 32), remaining in this situation for 48 to 72 hours. The pupa is formed posteriorly, attached to the substrate only by the cremaster and with coloration similar to the leaves, which gives them camouflage in the vegetation. After a certain period, which can range from five to ten days, the pupae present a white powdery surface from the dorsal projections of the head to the second abdominal segment (fig. 38). After a period that can last from 10 to 20 days, the adults emerge from the pupae, breaking the integument dorsoventrally from the anterior margin of A1 and following the outer margin of the forewing. Males and females emerge at the same time while eliminating a light-brown orange meconium and remain upside down, attached to the pupal exuviae for about half an hour until the complete wing spread.

Discussion

Recent descriptions of subspecies of *Morpho telemachus* were published after examining specimens with different wing color patterns recorded from outlined geographical distribution (BLANDIN, 2007; SCHÄFFLER & FRANKENBACH, 2008, 2009). Currently, 15 subspecies are recognized for this species, including the subspecies here described. Because subspecific names have been applied under different concepts, thus failing to reflect evolutionary units, we here argue in favor of describing *Morpho telemachus miersi* ssp. n., based on the same criteria proposed in BRABY (2012), which rely on the presence of diagnosable characters, a correlation with an evolutionary independent genetic structure, and partially isolated lineages.

Several butterfly species are polytypic, presenting many valid subspecific names related to the distribution. Neotropical examples can be found in every butterfly family, such as *Cyclargus ammon* (Lucas, 1857) (Lycaenidae) with 8 spp., *Apodemia mormo* (C. Felder & R. Felder, 1859) (Riodinidae) with 10 spp., *Pyrrhopage phidias* (Linnaeus, 1758) (Hesperiidae) with 11 spp., *Battus polydamas* (Linnaeus, 1758) (Papilionidae) with 20 spp., *Heliconius erato* (Linnaeus, 1758) (Nymphalidae) with 29 spp. (LAMAS, 2004); as well as in other *Morpho* species, such as *Morpho helenor* (Cramer, 1776) with 46 spp. (BLANDIN, 2007). Therefore, the presence of 15 subspecies of *Morpho telemachus* by itself would not be a novelty in butterfly systematics.

Still, subspecies are more often observed within groups that use visual signaling as part of reproductive strategies (KRISTENSEN, 2007). In this case, some factors such as diurnal habits, distinctive color pattern and large size contribute to the presence of a more evident geographical polymorphism. All these peculiarities fit the case of *Morpho telemachus*. Furthermore, the polymorphism patterns inferred from subspecific names are also quite similar to the distribution patterns of other butterfly groups in the Amazon (HALL & HARVEY, 2002), suggesting similar speciation processes occurring independently in groups with different histories.

The male genitalia of *Morpho telemachus miersi* do not differ from that of *Morpho telemachus telemachus*, though genitalia of *Morpho (Iphimedea)* species usually present unique particularities (see LE MOULT & RÉAL, 1962). Additionally, aspects of larval morphology and behavior are quite similar to other *Morpho telemachus* subspecies. The gregariousness here observed, as well as in BRÉVIGNON (2003) and GALLUSSER *et al.* (2010), is shared with other species, such as *Morpho sulkowskyi* Kollar, 1850 (HEREDIA & ÁLVAREZ-LÓPEZ, 2007), however, the circular conformation of this aggregation is recorded only in a few studies as seen in *Morpho menelaus godartii* Guérin-Méneville, [1844] (GUERRA-SERRUDO & LEDEZMA-ARIAS, 2008). However, it is not known if the other gregarious larvae have this behavior, or whether the same was not mentioned in previous studies. Other species that have been studied have solitary habits, contrary to those observed in *M. telemachus*, such as *Morpho menelaus amathonte* Deyrolle, 1860 (CONSTANTINO, 1997); *Morpho helenor*

macrophthalmus Frühstorfer, 1913; *Morpho helenor telamon* Röber, 1903 (CONSTANTINO & CORREDOR, 2004) and *Morpho rhodopteron* Godman & Salvini, 1880 (MONTERO-ABRIL & ORTIZ-PÉREZ, 2010). The jugular gland (fig. 40) mentioned in other works as the cervical gland (CONSTANTINO, 1997; HEREDIA & ÁLVAREZ-LÓPEZ, 2007; MONTERO-ABRIL & ORTIZ-PÉREZ, 2010) is observed from the first larval instar, but without the production of any strong odor when the larvae are handled as reported for other subspecies (BRÉVIGNON, 2003; GALLUSSER *et al.*, 2010). Further studies can be made to know if the absence of odor is normal for the subspecies, or is due to the change of the original host plant for *Abuta selliana* (Benth.) Eichler (Menispermaceae) after the eclosion of the first instar larvae.

The geographical distribution of the new subspecies is believed to be isolated from both the Amazon and Atlantic subspecies. In the type locality, forested fragments are isolated within an open habitat such as savanna (Cerrado), or more recently by agricultural crops. These forest patches are usually associated with river courses and are the only places in the region where *Morpho* butterflies can be found. Although some individuals were seen flying over the savanna, they quickly returned to the forested areas after a few minutes of flying around (pers. observ.). Moreover, males of *Morpho telemachus miersi* display a characteristic territorial behavior in certain spots, where they fight for the females. This behavior made it possible to collect the first adults, using brown-colored pieces of cloth as lures (see D'ALMEIDA, 1937). Thus, we have no reason to believe that this *Morpho* population may be able to disperse to other areas between forest patches.

The type locality is rarely present on distribution data of butterflies. Neither *Morpho telemachus*, nor any other *Morpho* species were ever recorded in the northern Cerrado (BLANDIN, 2007), although we have recorded there other common species of *Morpho*, such as *Morpho helenor* (Cramer, 1776) and *Morpho menelaus kesselringi* Fischer, 1962. Therefore, finding a distinctive *Morpho* butterfly in this area, besides contributing to filling one of the so-called distribution gaps of butterfly collecting data (NEILD, 2001), also suggests an interesting biological area for further biodiversity studies.

On the other hand, butterfly groups with collector market value such as *Morpho* butterflies, are also characterized by an inflated number of names given to geographical variants (PENZ & DEVRIES, 2002), sometimes as a means of raising the commercial value of specimens instead of contributing real biological information. In this case, the detailed biology of these butterflies needs to be seriously investigated, in search of relationships between wing color pattern and geographical distribution that may lead to the validity of these entities as diagnosable clusters (KRISTENSEN, 2007). Such relationships are also confirmed by molecular data within other groups (RATKIEWICZ & JAROSZEWICZ, 2006), suggesting that subspecies also occur at a molecular level. Thus, this description of *Morpho telemachus miersi* adds not only one more biological entity to the biodiversity of butterflies, but also shall contribute to future studies of diversification and dispersal of organisms in natural fragmented areas.

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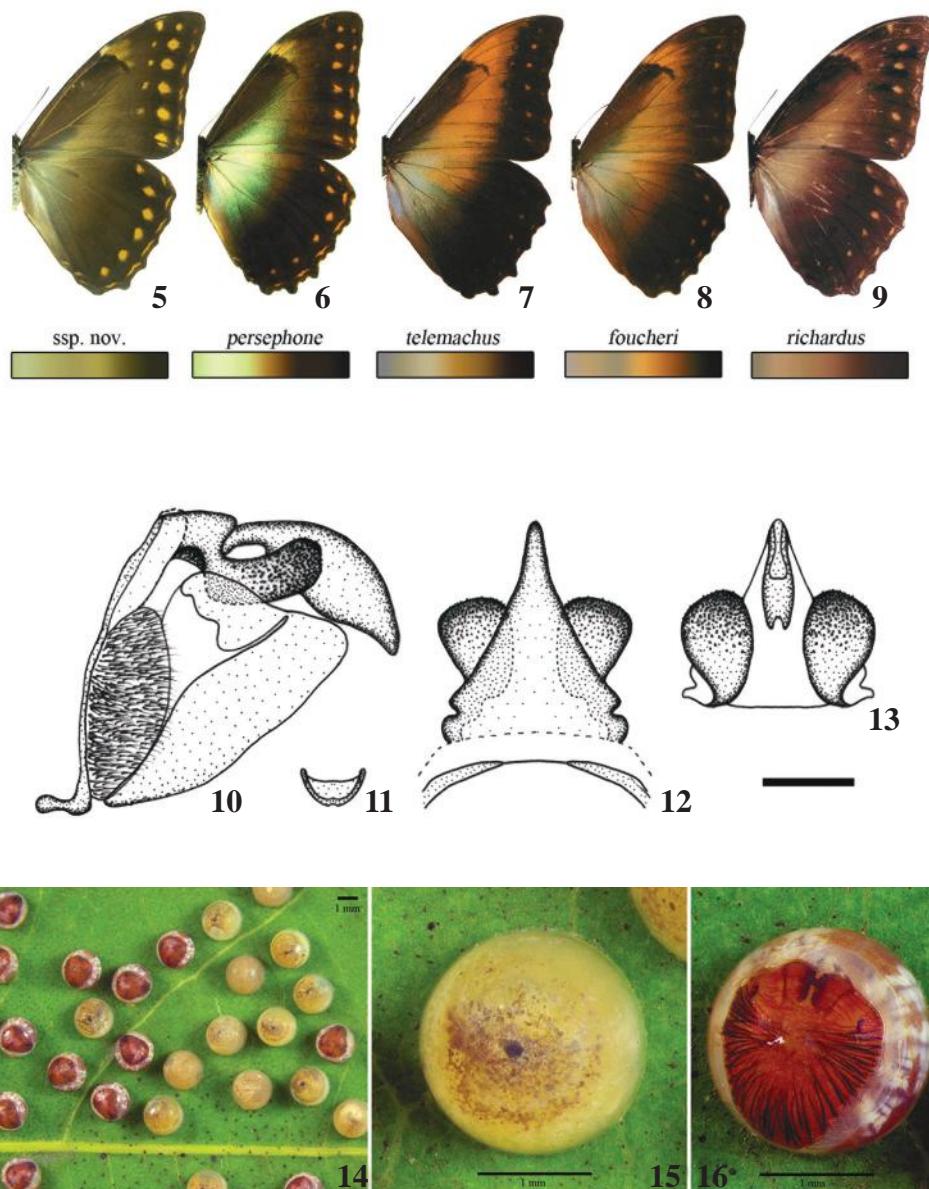
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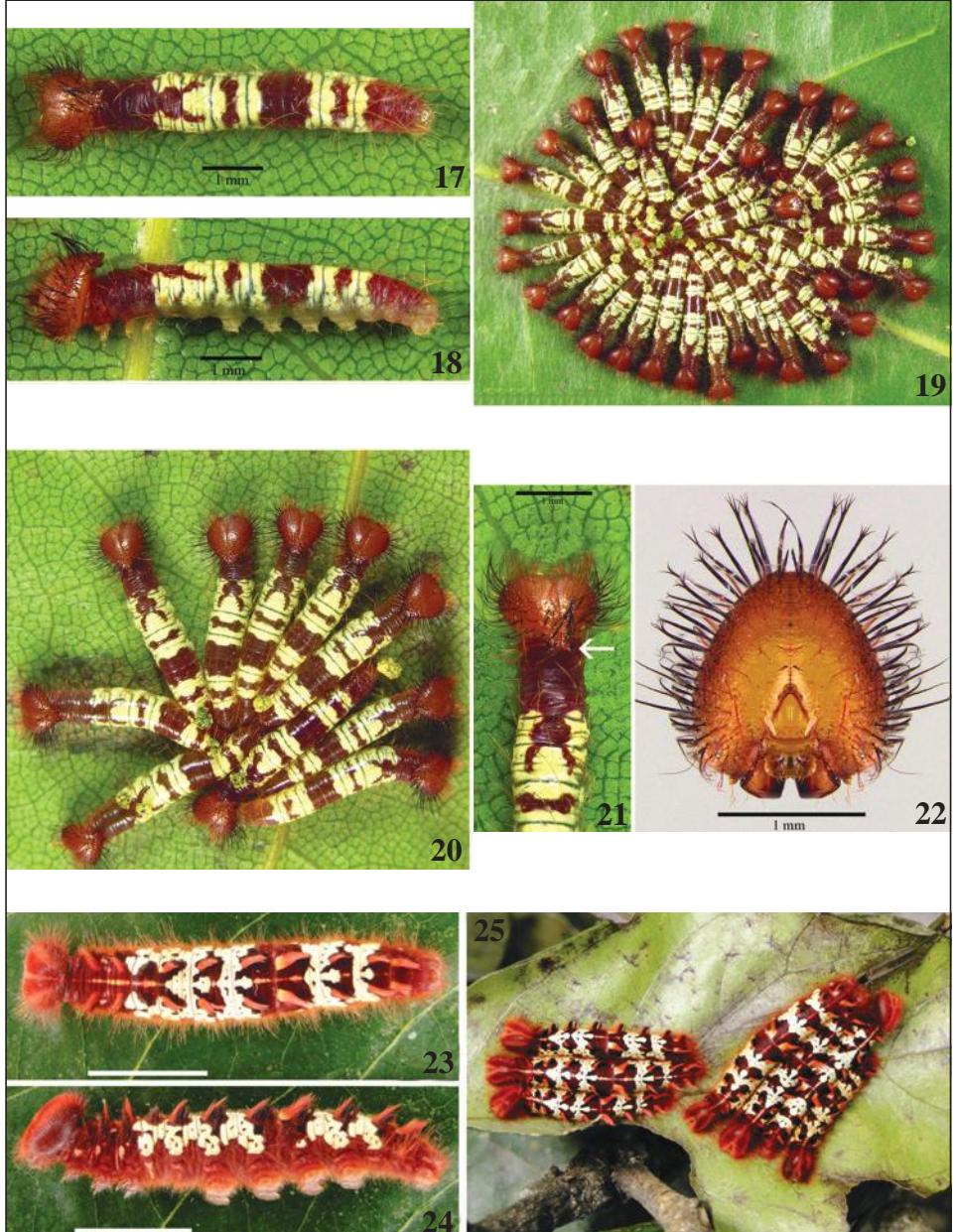
Figures 1-2.—*Morpho telemachus miersi* Leite, Carneiro, Mielke & Casagrande, ssp. n. Male (Holotype): 1. dorsal view; 2. ventral view. Scale bar = 1cm.



Figures 3-4.—*Morpho telemachus miersi* Leite, Carneiro, Mielke & Casagrande, ssp. n. Female (Allotype): 3. dorsal view; 4. ventral view. Scale bar = 1cm.



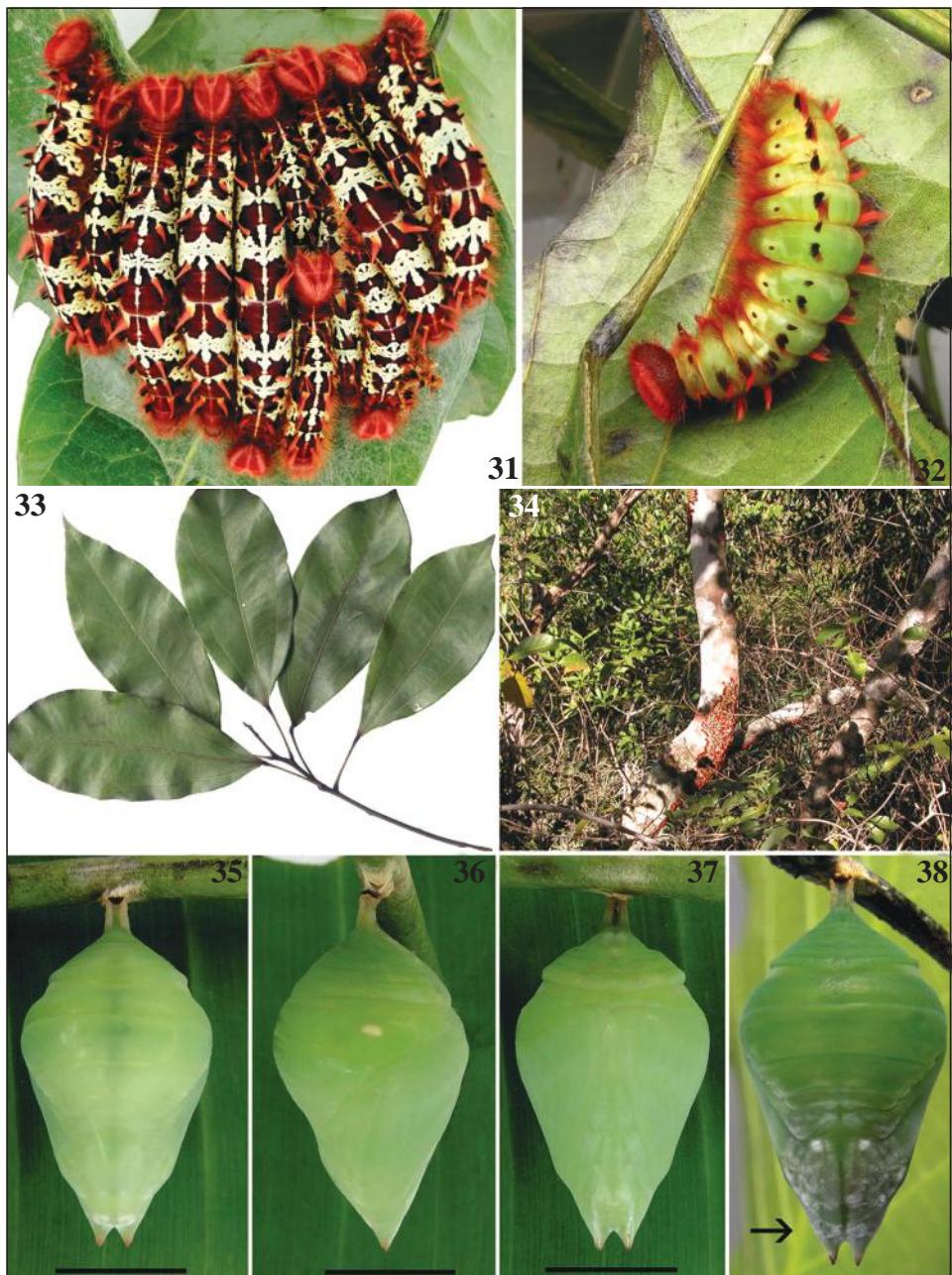
Figures 5-9.—Comparison between the dorsal alar patterns in the subspecies of *Morpho telemachus*: 5. *Morpho telemachus miersi* ssp. n., 6. *M. t. persephone*; 7. *M. t. telemachus*; 8. *M. t. foucheri*; 9. *M. t. richardus*. 10-13. Male genitalia of *Morpho telemachus miersi* ssp. n.: 10. Lateral view of tegument, saccus, uncus, gnathos and valva; 11. Fultura inferior posterior view; 12. Dorsal view of tegument, uncus and gnathos; 13. Ventral view of gnathos and uncus. Scale bar = 1mm. 14-16. Eggs: 14. Egg batch; 15. dorsal view of the egg.; 16°. egg near eclosion.



Figures 17-25.—*Morpho telemachus miersi* ssp. n. 17-22. 1st instar: 17. Dorsal view; 18. Lateral view; 19. Circular aggregation; 20. Beginning of the circular aggregation; 21. detail of the dorsal view, highlighting the dorsoposterior projection of the head; 22. head capsule. 4th instar: 23. Dorsal view; 24. lateral view; 25. Grouping on the leaf.



Figures 26-30.—*Morpho telemachus miersi* ssp. n. 4th instar: 26. Grouping in the shape of “cluster/bunch” on the petiole and leaf; 27. Spinning silk on the base of the petiole. Scale bar = 1cm. 5th instar: 28. dorsal view; 29. lateral view; 30. Spinning silk on the leaf.



Figures 31-39.—*Morpho telemachus miersi* ssp. n.; 31. 5th instar, lateral grouping on the leaf; 32. Prepupa; 33.—Original host plant (unknown); 34. Aggregation of the larvae on the trunk in the field; 35-38. Pupa: 35. Dorsal view; 36. Lateral view; 37. Ventral view; 38. Ventral view, highlighting the region of white powdery surface appearance. Scale bar = 1cm.

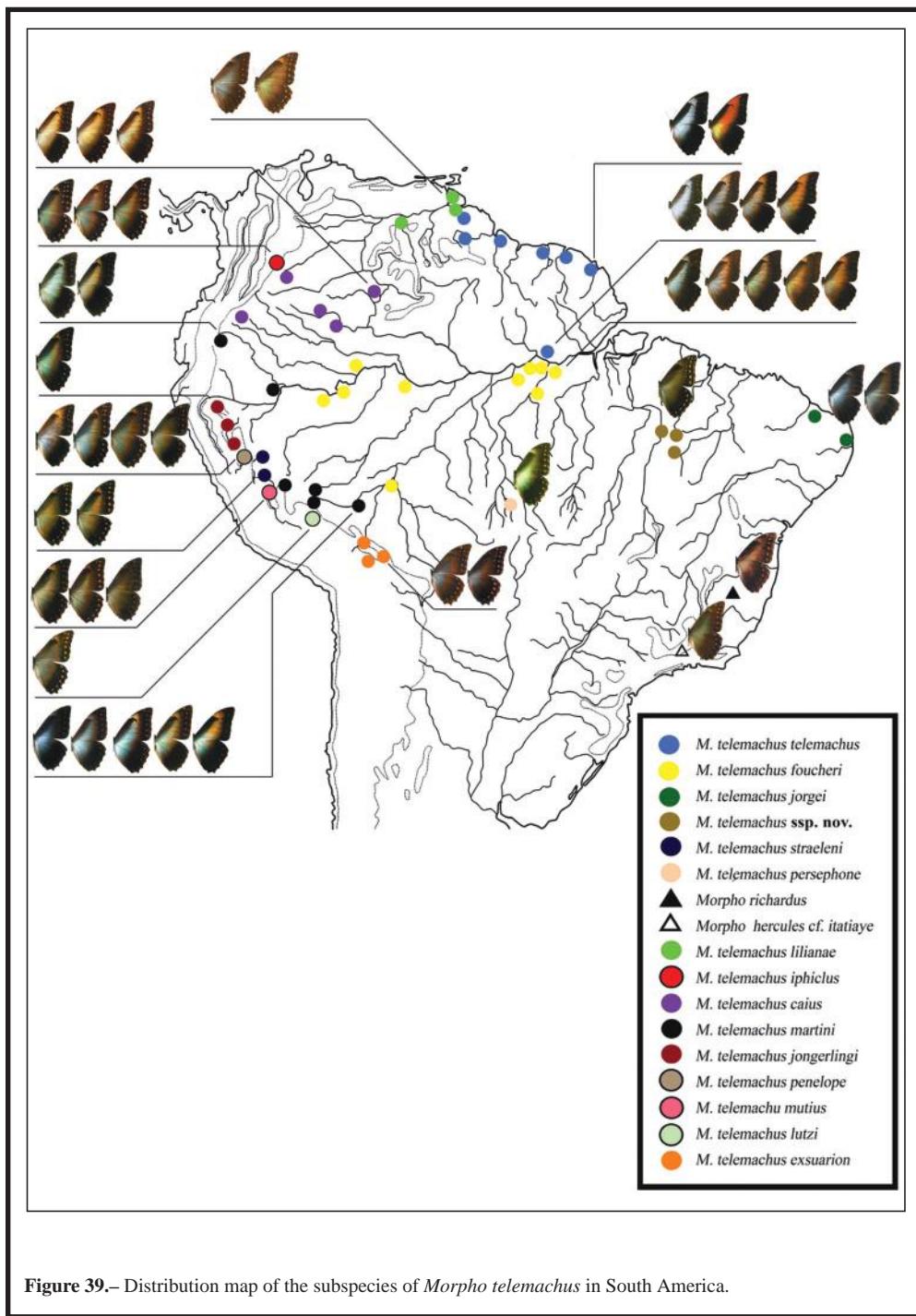
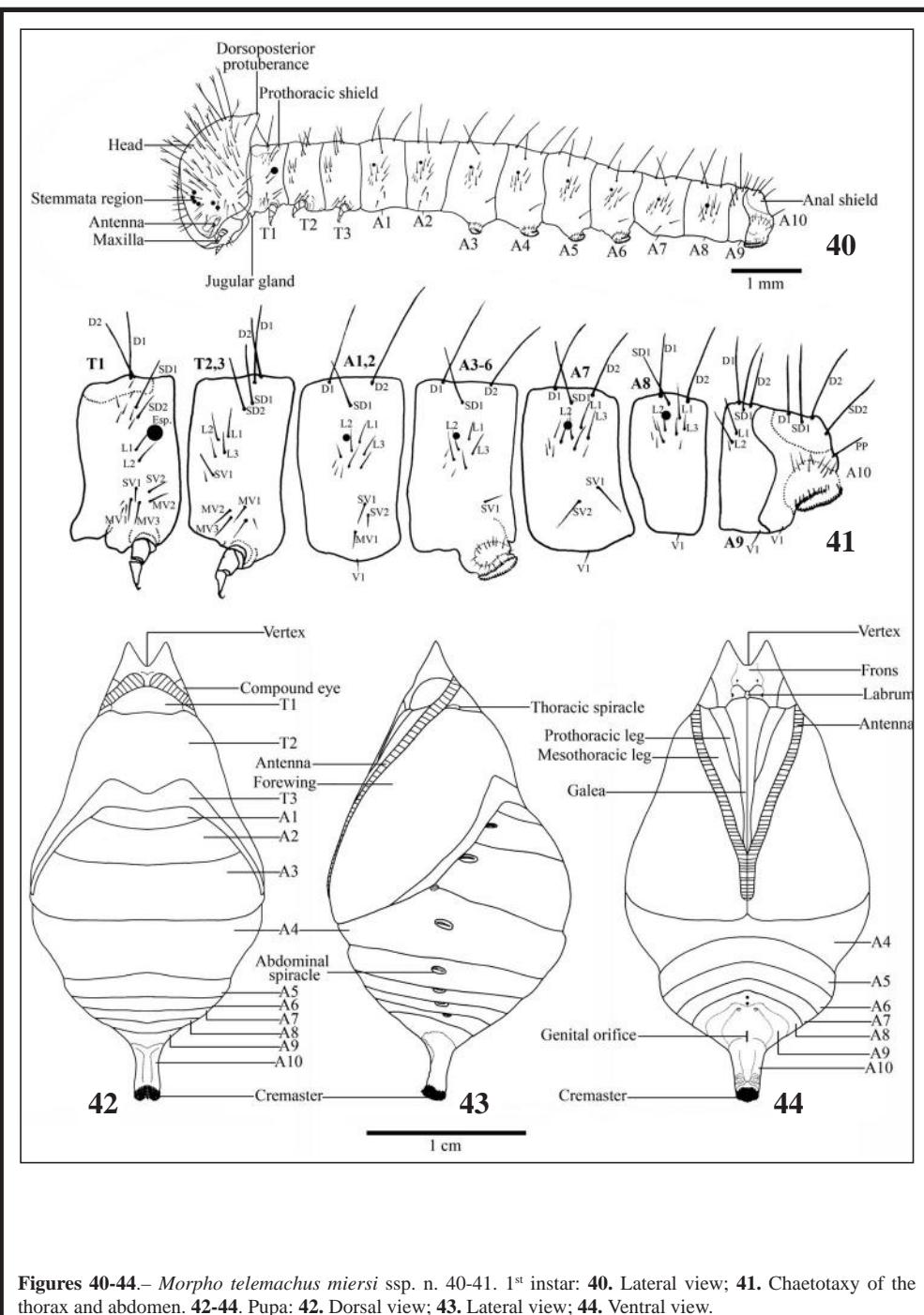
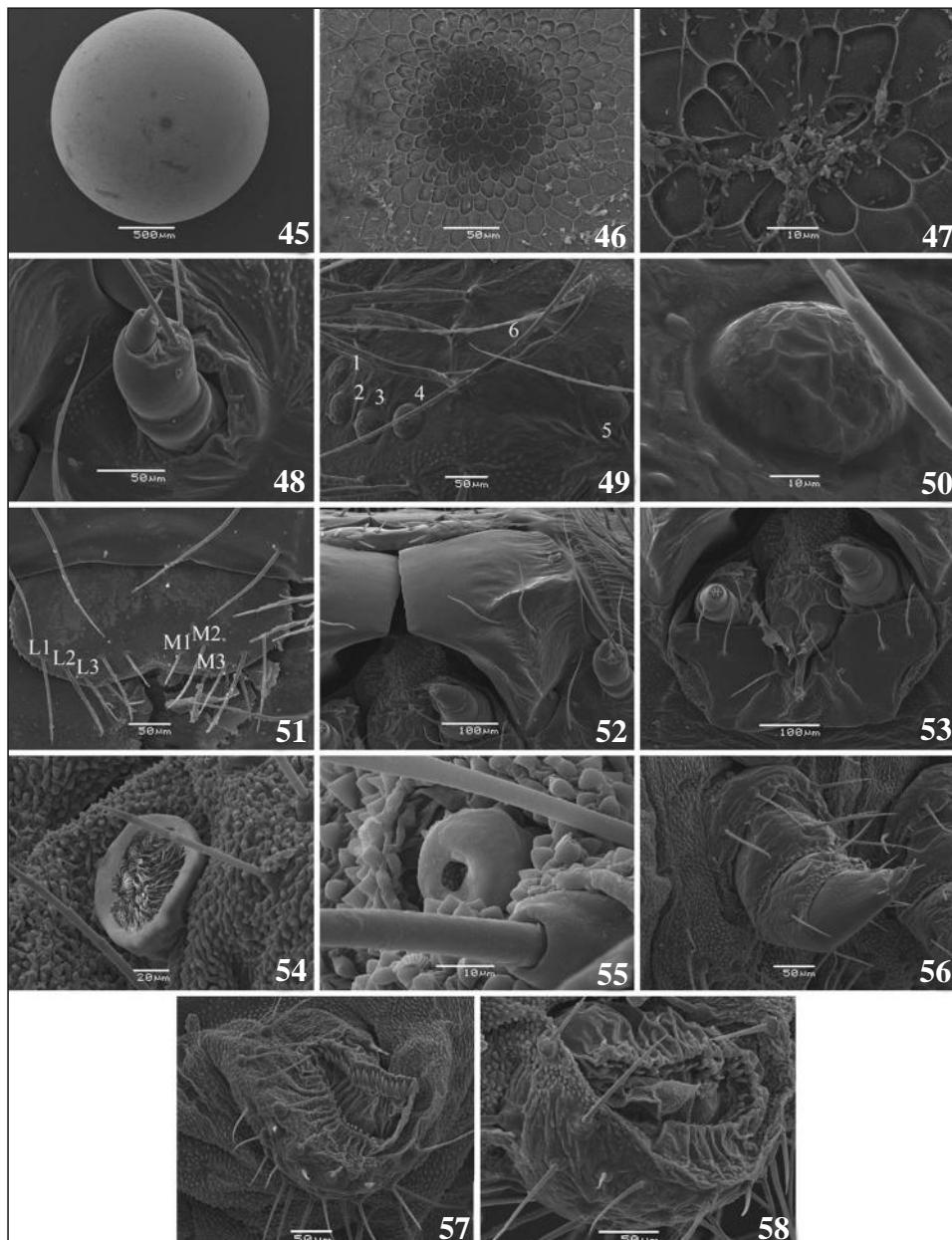


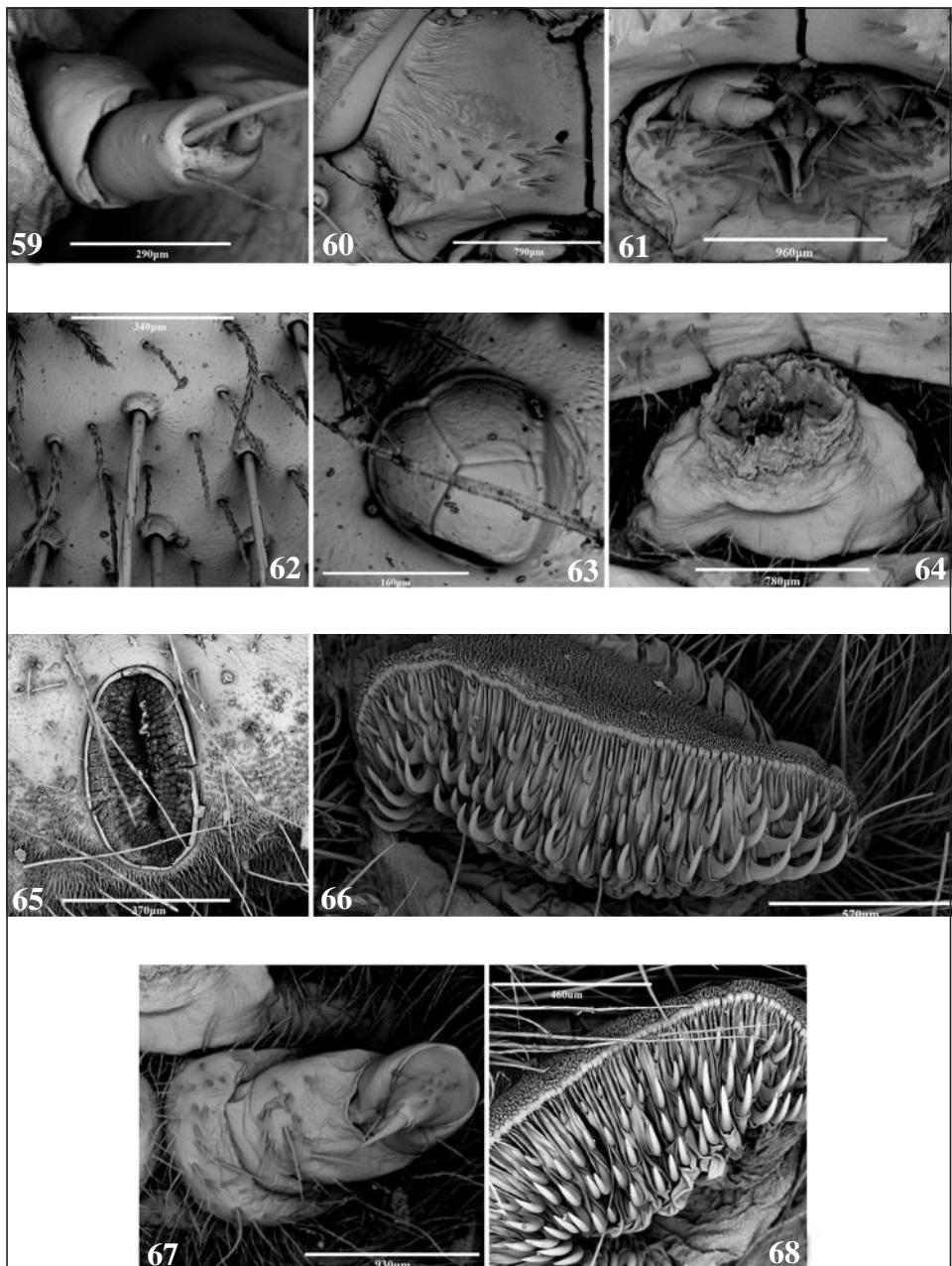
Figure 39.— Distribution map of the subspecies of *Morpho telemachus* in South America.



Figures 40-44.—*Morpho telemachus miersi* ssp. n. 40-41. 1st instar: **40.** Lateral view; **41.** Chaetotaxy of the thorax and abdomen. 42-44. Pupa: **42.** Dorsal view; **43.** Lateral view; **44.** Ventral view.



Figures 45-58.—*Morpho telemachus miersi* ssp. n. **45-47.** Egg: **45.** Dorsal view; **46.** Micropilar area; **47.** micropilla. **48-58.** 1st instar: **48.** Antenna; **49.** Stemma region; **50.** Stemma; **51.** Labrum; **52.** Mandible; **53.** Spinneret region; **54.** Thoracic spiracle; **55.** Abdominal spiracle; **56.** Thoracic leg; **57.** Leg of A3; **58.** Leg of A10.



Figures 59-68.—*Morpho telemachus miersi* ssp. n. 5th instar: **59.** Antenna; **60.** Mandible; **61.** Spinneret region; **62.** Setae on the head capsule; **63.** Stemma; **64.** Retracted jugular gland; **65.** Abdominal spiracle; **66.** Leg of A3; **67.** Thoracic leg; **68.** Leg of A10.